

What is claimed is:

1. In a pump having a housing with at least first and second rotary control valve that comprises (1) a rotary control member having a rotatable control surface having first and second flow channels inscribed in the control surface, without extending through the control member, with the first of the flow control channels including an arcuate control portion that communicates with a circular channel portion of greater diameter and a second of the flow control channels including an arcuate control portion of a same radius as the arcuate control portion of the first flow control channel, and with the arcuate control portion of the second flow control channel communicating with a circular channel of a smaller diameter than the arcuate control portion of the second flow control channel; (2) a plurality of reciprocating pistons; and (3) a stationary control plate that fits against the control surface to form closed passageways between the control plate and the first and second flow control channels in the control surface, with the control plate including a first primary opening through the control plate positioned to communicate with the circular portion of the first channel, a second primary opening through the control plate positioned to communicate with the circular portion of the second flow control channel, and a first secondary opening and a second secondary opening through the control plate, each separately positioned to communicate with the arcuate portions of both the first and second flow control channels, and further with the first and second secondary openings being in constant communication with respective first and second reciprocating pistons, such that each of the first and second primary openings is successively brought into fluid communication with the first and second secondary openings during different portions of the control surface rotation, whereby

fluid communication is successively established between each of the reciprocating pistons and the primary inlet opening as the control surface rotates, and fluid communication is successively established between each of the reciprocating pistons and the primary outlet opening as the control surface rotates, the improvement comprising: at least one of the control surface and the control plate being formed from a self-lubricating material that has a coefficient of friction that is less than 0.25.

2. The pump of claim 1, wherein at least one of the control surface and the control plate is formed from a material that has a coefficient of friction that is less than 0.2.

3. The pump of claim 1, wherein at least one of the control surface and the control plate is formed from a material that has a coefficient of friction that is less than 0.1.

4. The pump of claim 1, wherein both the control valve and the control plate are formed from a self-lubricating material that has a coefficient of friction that is less than 0.25.

5. The pump of claim 1, wherein the control surface and the control plate are formed from dissimilar materials, with one of the control surface and the control plate comprising a metal, a polymer and a ceramic, and the other of the control surface and the control plate comprising a different one of the a metal, a polymer and a ceramic.

6. The pump of claim 5, wherein at least one of the control surface and the control plate is formed from a metal comprising at least one of stainless steel and titanium.

7. The pump of claim 5, wherein at least one of the control surface and the control plate is formed from a polymer comprising at least one of an acetal and a polyimide.

8. The pump of claim 5, wherein at least one of the control surface and the control plate is formed from a ceramic material.

9. The pump of claim 1, wherein at least one of the control surface and the control plate are formed from a material that will not expand more than 1% when exposed to a stream that includes at least 30 wt% of a carbon-containing feedstock.

10. The pump of claim 9, wherein both the control surface and the control plate are formed from a material that will not expand more than 1% when exposed to a stream that includes at least 30 wt% of a carbon-containing feedstock.

11. The pump of claim 9, wherein at least one of the control surface and the control plate are formed from a material that will not expand more than 0.5% when exposed to a stream that includes at least 30 wt% of a carbon-containing feedstock.

12. The pump of claim 9, wherein at least one of the control surface and the control plate are formed from a material that will not expand when exposed to a stream that includes at least 30 wt% of a carbon-containing feedstock.

13. The pump of claim 1, wherein the control plate is formed from a harder material than the control surface.

14. The pump of claim 1, wherein the improvement further comprises at least one aligning collar extending around each of the plurality of pistons and adapted to align the piston within the corresponding passageway, wherein each collar is mounted within the pump and includes at least a piston-contacting surface that is formed from a self-lubricating material.

15. The pump of claim 14, wherein each collar is formed from a material that will not expand more than 1% when exposed to a stream containing at least 30 wt% of a carbon-containing feedstock.

16. The pump of claim 1, wherein the improvement further comprises at least one seal extending around each of the plurality of pistons, wherein the seal comprises a body with a base that extends around the piston and a pair of spaced-apart arms that define a channel extending therebetween, with the arms and the channel each extending around the piston, and further wherein the seal comprises a resilient annular member seated within the channel and adapted to bias the arms generally away from each other, with one of the arms being biased against the piston.

17. A fuel processing system, comprising:

a hydrogen-producing region adapted to produce a mixed gas stream containing hydrogen gas and other gases from a feed stream comprising at least 30 wt% of a carbon-containing feedstock; and

a feedstock delivery system adapted to deliver the feed stream to the hydrogen-producing region, wherein the feedstock delivery system includes at least one pump, the pump comprising:

a housing defining a plurality of passages;

a plurality of reciprocating pistons adapted to be reciprocatingly driven within the plurality of passages;

a rotary control valve comprising a rotary control member having a rotatable control surface having at least first and second flow channels inscribed in the control surface, without extending through the control member, wherein the first of the flow control channels includes an arcuate control portion that communicates with an arcuate channel portion of greater diameter and a second of the flow control channels includes an arcuate control portion that corresponds to the the arcuate control portion of the first flow control channel, and with the arcuate control portion of the second flow control channel communicating with a second arcuate channel having different dimensions than the arcuate control portion of the second flow control channel;

a stationary control plate that fits against the control surface to form closed passageways between the control plate and the first and second flow control channels in the control surface, with the control plate including a first primary opening through the control plate positioned to communicate with the arcuate portion of the first

channel, a second primary opening through the control plate positioned to communicate with the arcuate portion of the second flow control channel, and a first secondary opening and a second secondary opening through the control plate, each separately positioned to communicate with the arcuate portions of both the first and second flow control channels, and further with the first and second secondary openings being in constant communication with respective first and second reciprocating pistons, such that each of the first and second primary openings is successively brought into fluid communication with the first and second secondary openings during different portions of the control surface rotation, whereby fluid communication is successively established between each of the reciprocating pistons and the primary inlet opening as the control surface rotates, and fluid communication is successively established between each of the reciprocating pistons and the primary outlet opening as the control surface rotates;

a plurality of collars mounted in the housing, formed from a different material than the housing, and adapted to align at least the first and the second reciprocating pistons within the corresponding plurality of passages; and

a plurality of seals positioned in the housing and adapted to extend around at least the first and the second reciprocating pistons, wherein each of the seals comprises a body with a base that extends around the piston and a pair of spaced-apart arms that define a channel extending therebetween, with the arms and the channel each extending around the piston, and further wherein the seal comprises a resilient annular member seated within the channel and adapted to bias the arms generally away from each other, with one of the arms being biased against the corresponding piston.

18. The fuel processing system of claim 17, wherein at least one of the control surface and the control plate is formed from a self-lubricating material that has a coefficient of friction that is less than 0.25.

19. The fuel processing system of claim 17, wherein at least one of the control surface and the control plate are formed from a polymeric material that comprises at least one polyimide, acetyl or combinations thereof.

20. The fuel processing system of claim 17, wherein at least one of the control surface and the control plate is formed from titanium, stainless steel, or combinations thereof.

21. The fuel processing system of claim 17, wherein the feed stream further comprises water.

22. The fuel processing system of claim 17, wherein the carbon-containing feedstock includes at least one hydrocarbon, alcohol or mixtures thereof.